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(54) **CHROMIUM BLACK LIGHT SHIELD**

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(58) **Field of Search** 359/614, 601, 359/605, 613

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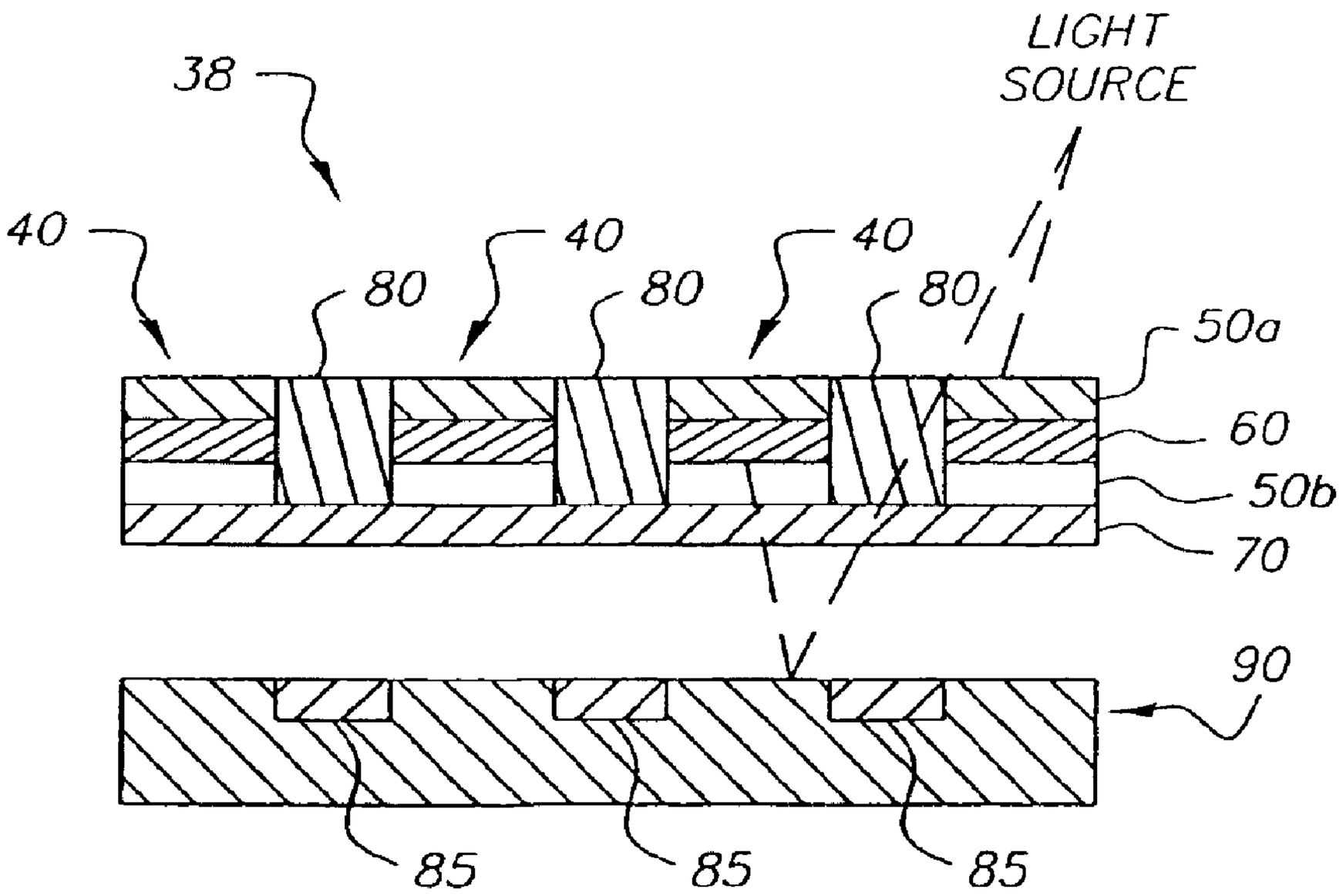
(57) **ABSTRACT**

A black light shield for preventing incident light from being received by light receiving elements, the black shield includes a support structure; a first CrO_x layer disposed over the support structure for absorbing the incident light in a substantially reflected transmission path; and a second CrO_x layer disposed integral with the support structure for absorbing the incident light in a substantially non-reflected transmission path.

14 Claims, 1 Drawing Sheet



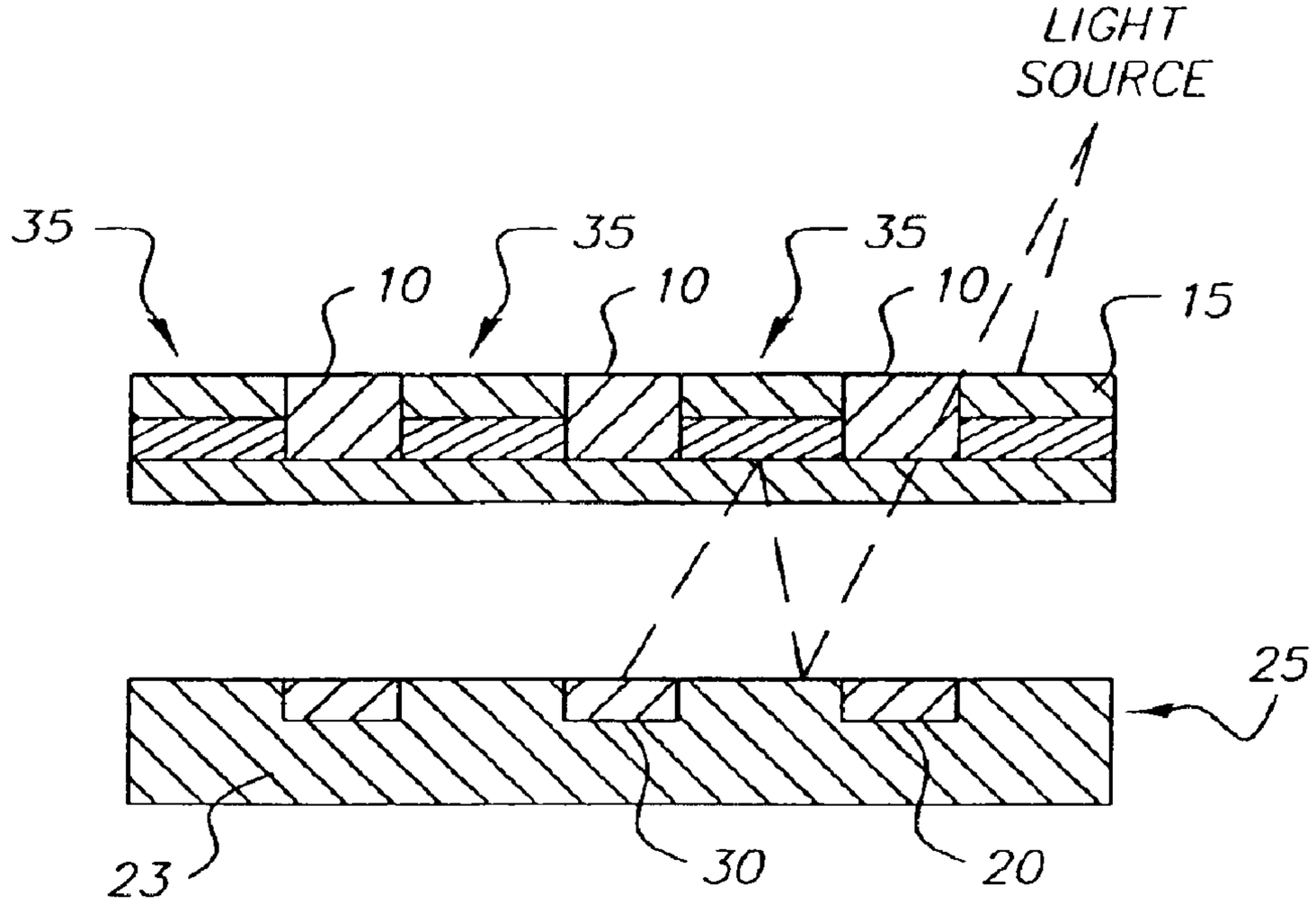


FIG. 1
(PRIOR ART)

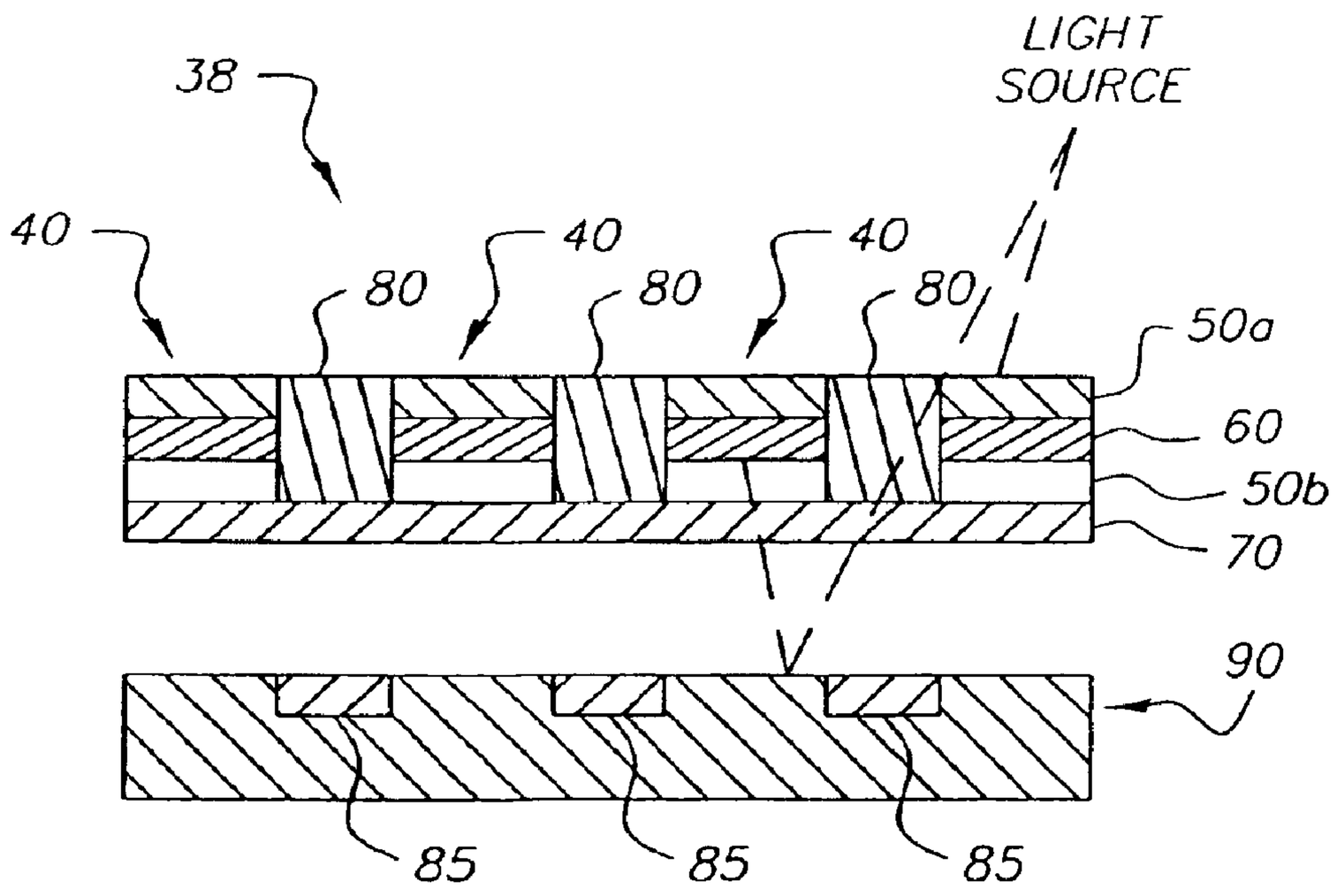


FIG. 2

CHROMIUM BLACK LIGHT SHIELD

FIELD OF THE INVENTION

The invention relates generally to the field of black light shields for image sensors, more particularly, to such black light shield that absorbs light from a plurality of transmission paths for absorbing undesirable stray light.

BACKGROUND OF THE INVENTION

Solid state image sensors are made of a grid of many smaller sensor elements. Each of these sensor elements is commonly referred to in the art as a "pixel." In operation, light shone on the active pixels generates an electrical charge that is translated into a digital image. Since image sensors are used for color imaging, in many cases, a color filter array (CFA) is placed over the image sensor. However, in order to separate the light into color bands or components, color separation inputs are required. Depending on the configuration of the image sensor, some times these CFA are spaced apart from each other. When doing this spacing, it is desirable to use some type of light blocking or light absorbing material. This color separation is achieved in many ways in the prior art.

One such way is to have chromium oxide and chromium metal disposed on a substrate. Although satisfactory, this arrangement includes drawbacks. One such drawback is that light intended for one color channel may be reflected or directed to another color channel. For example, and referring to FIG. **1**, a portion of the light (not shown) passes to its intended pixel **20**. Another portion of the light is absorbed by the chromium oxide **15** as shown, and an undesirable stray portion of the light passes through a first color filter **10** at an angle such that it is not absorbed by its intended pixel **20**, but instead passes to the substrate **23** of the color light sensing device **25** that is beneath the black light shield **35**. This light is then reflected by the chromium metal surface of the black light shield **35** to an adjacent color channel **30**. This is obviously undesirable.

Consequently, a need exists for a black light shield that prevents light from one color channel from being reflected or directed to another color channel.

SUMMARY OF THE INVENTION

The present invention is directed to overcoming one or more of the problems set forth above. Briefly summarized, according to one aspect of the present invention, the invention resides in a black light shield for preventing incident light from being received by light receiving elements, the black light shield includes (a) a support structure; (b) a first CrO_x layer disposed over the support structure for absorbing the incident light in a substantially reflected transmission path; and (c) a second CrO_x layer disposed integral with the support structure for absorbing the incident light in a substantially non-reflected transmission path.

These and other aspects, objects, features and advantages of the present invention will be more clearly understood and appreciated from a review of the following detailed description of the preferred embodiments and appended claims, and by reference to the accompanying drawings.

Advantageous Effect of the Invention

The present invention has the following advantages of a black light shield that is constructed of a three or more layer stack incorporating chromium oxide and chromium metal. The advantage of this configuration is that reflectivity from both sides of the black light shield is made very low while simultaneously controlling transmission through the black light shield, and additionally, stress can be controlled.

Since the black light shield is made of similar materials, chromium metal and chromium oxide, the black light shield tailors itself very well to processes widely used in the semiconductor industry such as photolithography and wet etching. Thus, this makes the black light shield very easily patterned for use in many designs with commercially available chemistry.

Still further, the black shield may be easily re-patterned in a different manner through the use of wet or dry etch.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a cutaway view of a prior art image sensor; and

FIG. **2** is a cutaway view of the image sensor of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. **2**, an image sensor **38** of the present invention is shown. The image sensor includes a plurality of black light shields **40** patterned with a plurality of color filters **80** in a predetermined configuration, alternating strips in the preferred embodiment. Although the preferred embodiment illustrates alternating strips, those skilled in the art will readily recognize that there are a variety of alternative configurations. It is instructive to note that most of the incoming light (not illustrated) will pass through the color filters **80** and onto its intended pixel **85**. Some light will not pass to its intended pixel **85**, and this stray light is shown in FIG. **1** for illustrating the advantageous effect of the present invention. In this regard, the present invention includes three layers of both chromium oxide **50** and chromium metal **60** that are fabricated on a suitable support structure or substrate, such as quartz, glass or silicon **70**. More particularly, the black light shield **40** includes two layers of chromium oxide **50** respectively layered over a side of the chromium metal **60**. As discussed hereinabove, color filters **80** are positioned between the black light shields **40** for permitting light to pass to their respective pixels. It is instructive to note that the chromium oxide layers **50** are both non-reflective and non-transmissive. The reasons for making the black light shield non-reflective from both sides and non-transmissive are as follows. When placed over the light sensing device **90**, light can enter at oblique angles and reflect off either the packaging (not shown) or the light sensing device imager **90**. This stray reflection from the light sensing device **90** is absorbed by the chromium oxide layer **50***b* and not reflected back into the active pixel area **85** of the sensor **38**. It is instructive to also note that a portion of the light is directly absorbed by the chromium oxide layer **50***a*.

Both sides of the black light shield are made to have very low reflectance, well under 5%, which allows for very little interference from stray light. This is done by making an interference layer out of the chromium oxide layers **50***a* and **50***b*. By controlling various parameters during deposition, the thickness and percent reflectivity are controlled.

By depositing the chromium metal layer **60** in between the chromium oxide layers **50** you can control the amount of light that transmits through the black light shield **40**. This layer **60** is also the layer that has a great influence on the overall stress of the black light shield. By increasing or decreasing the amount of chromium metal **60** deposited the black light shield **40** is made more compressive or tensile.

The chromium oxide layers have a smaller range of thickness compared to the chromium metal layer; for

example, between 500 to 1000 angstroms of thickness. This can be varied to optimize the desired reflectivity of the black light shield **40** dependent on the material the CrO_x interfaces with. The chromium metal layer **60** only has to be thick enough to block the transmission of light, but as mentioned above, this layer also serves as a stress controlling layer and can be made several microns thick if needed.

The invention has been described with reference to a preferred embodiment. However, it will be appreciated that variations and modifications can be effected by a person of ordinary skill in the art without departing from the scope of the invention.

PARTS LIST

10	color filters
15	chromium oxide
20	pixel
23	substrate
25	color light sensing device
30	adjacent color channel
35	black light shield
38	image sensor
40	black light shields
50	chromium oxide layers
50a	chromium oxide layer
50b	chromium oxide layer
60	chromium metal
70	substrate
80	color filters
85	pixels
90	light sensing device

What is claimed is:

1. A black light shield for preventing incident light from being received by a plurality of pixels of an image sensor, the black shield comprising:

(a) a support structure;

(b) a first CrO_x layer disposed spanning the support structure for absorbing the incident light in a substantially reflected transmission path; and

(c) a second CrO_x layer disposed spanning the support structure for absorbing the incident light in a substantially non-reflected transmission path; wherein the plurality of pixels of the image sensor span at least a portion of the substrate in a predetermined pattern and receive the incident light.

2. The black light shield as in claim **1** further comprising:

(e) chromium metal disposed between the first CrO_x and the second CrO_x for blocking residual light transmitted through either the first or second CrO_x.

3. The black light shield as in claim **1**, wherein the support structure is either quartz, glass or silicon substrate.

4. The black light shield as in claim **1**, wherein the first CrO_x is chromium oxide.

5. The black light shield as in claim **4**, wherein the second CrO_x is chromium oxide.

6. The black light shield as in claim **5**, wherein the first and second chromium oxide each having a thickness of substantially between 500 to 1000 angstroms.

7. The black light shield as in claim **1** further comprising (d) a plurality of color filters disposed in both the first and second CrO_x layer for permitting a portion of the incident light to be received by the pixels.

8. A method for preventing incident light from being received by a plurality of pixels of an image sensor, the method comprising the steps of:

(a) providing a support structure;

(b) providing a first CrO_x layer disposed spanning the support structure for absorbing the incident light in a substantially reflected transmission path; and

(c) providing a second CrO_x layer disposed spanning the support structure for absorbing the incident light in a substantially non-reflected transmission path; wherein the plurality of pixels of the image sensor span at least a portion of the substrate in a predetermined pattern and receive the incident light.

9. The method as in claim **8** further comprising the step of (e) providing chromium metal disposed between the first CrO_x and the second CrO_x for blocking residual light transmitted through either the first or second CrO_x.

10. The method as in claim **8** further comprising the step of providing the support structure as either quartz, glass or silicon substrate.

11. The method as in claim **8** further comprising the step of providing the first CrO_x as chromium oxide.

12. The method as in claim **11** further comprising the step of providing the second CrO_x as chromium oxide.

13. The method as in claim **12** further comprising the step of providing the first and second chromium oxide each having a thickness of substantially between 500 to 1000 angstroms.

14. The method as in claim **8** further comprising (d) providing a plurality of color filters disposed in both the first and second CrO_x layer for permitting a portion of the incident light to be received by the pixels.

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